



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2020/2021**

COURSE NAME : POLYPHASE CIRCUIT ANALYSIS
COURSE CODE : BEF 23803
PROGRAMME CODE : BEV
EXAMINATION DATE : JULY 2021
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4) PAGES**

TERBUKA

- Q1** (a) List the steps involved in analysing the unbalanced three-phase system using the Milman's Theorem. (4 marks)
- (b) Define the unbalanced three-phase electrical system. (2 marks)
- (c) A balanced 230 V phase voltage of Y-connected three-phase supply feeds an unbalanced delta-connected load. The phase impedances of the load are:

$$Z_{AB} = -j5 \Omega$$

$$Z_{BC} = j10 \Omega$$

$$Z_{CA} = 10 \Omega$$

- (i) Determine the phasor diagram of the currents. (12 marks)
- (ii) Calculate the power absorbed by the load. (2 marks)
- Q2** (a) Sketch the single line diagram symbol for:
- (i) Generator. (2 marks)
- (ii) Two winding transformer. (2 marks)
- (b) The single line diagram of a small network is as shown in **Figure Q2(b)**. Calculate the real power, reactive power, apparent power and the line currents throughout the network. (16 marks)
- Q3** (a) Three identical Y-connected loads, each having a resistance of 20Ω in parallel with an inductance of 0.5 H , are connected to a three phase supply of 400 V of 50 Hz frequency. Determine the real power, reactive power, apparent power and the power factor at the load terminals. (10 marks)
- (b) Explain **five (5)** advantages of Y-Y connected three-phase transformer. (10 marks)

Q4 (a) Describe the medium line model of a transmission line. (4 marks)

(b) A 220 kV, 150 MVA, 50 Hz, three-phase transmission line is 140 km long. The characteristic parameters of the transmission line are given as below:

$$\begin{aligned}r &= 0.09 \Omega/\text{km} \\x &= 0.88 \Omega/\text{km} \\y &= 4.1 \times 10^{-6} \text{ S/km}\end{aligned}$$

The voltage at the receiving end of the transmission line is 210 kV. By using short line model:

(i) Calculate the series impedance and shunt admittance of this transmission line. (3 marks)

(ii) Calculate the sending end line voltage and phase voltage, if the line is supplying at rated line voltage and apparent power of 0.85 pf lagging. (5 marks)

(iii) Calculate the voltage regulation and the efficiency of the transmission line in **Q4(b)(ii)**. (8 marks)

Q5 (a) Define per unit principle in electrical power system. (4 marks)

(b) Construct the impedance and reactance diagrams for the system in **Figure Q5(b)** and express all of the quantities in per unit. Use a common base of 100 MVA and 13.2 kV on the transmission line. The generator has a synchronous reactance of 0.18 p.u. The line is 65 km long with resistance and reactance of 0.1 Ω/km and 0.5 Ω/km respectively. (16 marks)

- END OF QUESTIONS -

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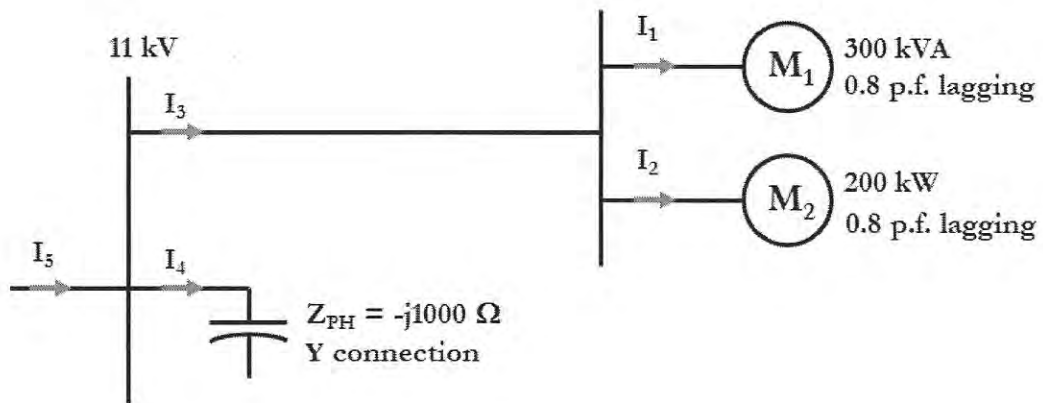


Figure Q2(b)

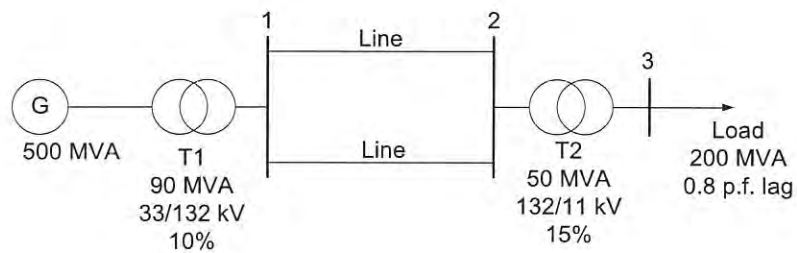


Figure Q5(b)